

**DRAFT REVISED ENVIRONMENTAL ASSESSMENT,  
MANAGEMENT PLAN, AND IMPLEMENTATION GUIDANCE:  
FALCONRY TAKE OF NESTLING AMERICAN PEREGRINE  
FALCONS IN THE CONTIGUOUS UNITED STATES AND  
ALASKA**

U.S. Fish and Wildlife Service  
Division of Migratory Bird Management

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## NOTE

This revised Environmental Assessment and Management Plan explains our analysis of available information on American peregrine falcons in the western United States, the alternatives we considered in evaluating possible take of nestlings for falconry, and our selection of a preferred alternative.

We prepared this document to correct an error in the representation of the modeling done for the draft and final Environmental Assessment in 2000 and 2001. Though peregrines occasionally breed in their second year, to be conservative we intended to model first breeding at age three. In the models in the earlier assessment, the breeding age for American peregrines was inadvertently set at two years of age. In this version we evaluate the effects of the proposed and alternative actions with varying proportions of two-year old peregrines breeding, which more closely approximates actual conditions.

To reflect changes in the population of American peregrine falcons in the West since delisting, we used data provided by the States on the numbers of nesting pairs and productivity since delisting. With those data, the evaluations herein are based on the most current data available. Those data show that recent productivity has averaged about 1.51 young produced per nesting attempt, and that the known contiguous western U.S. population is at least 10% larger than it was in 1998.

Data from the States indicate that the population of breeding American peregrine falcons in the West has grown since 1998 at rates greater than projected in earlier models. Our conversations with State biologists and the data summaries they provided indicate that the change was largely due to population growth rather than to increased search effort. Therefore, it is clear that one of the parameters used in the original modeling was incorrect.

- The current productivity data were provided by the States and are as accurate as possible.
- Based on published data, 62.5% is a reasonable, but conservative estimate of first-year mortality, so we continued to use this value in our assessment.
- Our analyses suggest the most important factor driving the rate of change in peregrine populations is adult mortality. Using 20% annual post-first-year mortality in the corrected models, we found that the population could not show the population growth that the data provided by the States indicated. We concluded that the estimates of post-first-year mortality were too high. We reevaluated the post-first-year mortality estimate as part of this revision of the Environmental Assessment.

## ABSTRACT

- We considered six alternatives for take of nestling American peregrine falcons (*Falco peregrinus anatum*) in Alaska and the contiguous United States west of 100° longitude. We based this assessment on recent population and productivity data for the western States.
- The alternatives we considered were no action, which would mean no take; take of 5, 10, 15 and 20 percent of annual production; and no restrictions on take beyond the existing falconry regulations.
- Rather than basing our decision on population growth with specific mortality and productivity rates, in this revision we focused on the effects on the rates of change in the population that would result from different levels of take.
- We determined that take of 5% of the nestlings would reduce the rate of population increase by about 0.7%. The take we believe might actually be allowed by the States would only affect the rate of population change by about 0.5%. This level of take is so small that it would be undetectable in any practical population monitoring.
- The proposed action is a maximum take of 5% of nestlings in each State west of 100° longitude. Within that limit, take will be regulated by the State consistent with the Federal falconry standards. Authorized take would be based on the most recent nesting population data for each State.

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## INTRODUCTION

The peregrine falcon (*Falco peregrinus*) is one of the most widespread and best-known raptor species. It is found on all continents except Antarctica, and on many of the larger islands in the oceans. The American peregrine falcon (*Falco peregrinus anatum*) occurs throughout much of North America from the subarctic boreal forests of Alaska and Canada south to Mexico. It nests from central Alaska, central Yukon Territory, and northern Alberta and Saskatchewan, east to the Maritimes and south (excluding coastal areas north of the Columbia River in Washington and British Columbia) throughout western Canada and the United States to Baja California, Sonora, and the highlands of central Mexico. American peregrine falcons that nest in subarctic areas generally winter in South America. Migration of those that nest at lower latitudes is more variable; some are nonmigratory (Yates *et al.* 1988).

Peregrine falcons declined precipitously in North America following World War II (Kiff 1988). Research implicated chlorinated hydrocarbon pesticides, mainly DDT, used in the U.S. and Canada as causing the decline (see Risebrough and Peakall 1988). Chlorinated hydrocarbons, including DDT and its principal metabolite DDE, aldrin, dieldrin, and others, are stable, persistent compounds stored in fatty tissues of animals that ingest contaminated food (Fyfe *et al.* 1988). Use of these chemicals peaked in the 1950s and early 1960s and continued through the early 1970s. These chemical compounds seriously affected reproduction of peregrine falcons, particularly in the eastern U.S., where peregrines were essentially extirpated by the mid-1960s (Berger *et al.* 1969). Because of the decline, the American peregrine falcon was added to the list of endangered and threatened wildlife and plants in 1970.

Efforts beginning in the early 1970s to reestablish peregrine falcons in the eastern and midwestern U.S. successfully returned this species to areas from which it was extirpated by the 1960s. Peregrine falcons now nest in most States in their historical range east of 100° longitude, and are widespread in the West. In 1998, the population of American peregrine falcons included 1650 pairs in the U.S. and Canada. Recovery plan productivity goals in all of the American peregrine falcon recovery regions were met or exceeded. This and other information on measures of American peregrine falcon recovery led the U.S. Fish and Wildlife Service to remove the American peregrine falcon from the list of endangered and threatened wildlife and plants in August 1999 (USFWS 1999a). When it was delisted, management of the species shifted from the Division of Threatened and Endangered Species to the Division of Migratory Bird Management (DMBM). Regulations promulgated under the Migratory Bird Treaty Act allow activities that may remove individuals of some species from the wild, including take for falconry. Those activities are evaluated, permitted, and reviewed by the DMBM.

In June 1999, anticipating delisting, State fish and wildlife agencies, through the International Association of Fish and Wildlife Agencies (IAFWA), proposed allowing take of nestling peregrines for falconry (Taubert *et al.* 1999). The States proposed a 5% take of nestling American peregrine falcons based on the most recently documented annual production of young in States west of 100° longitude (*i.e.* Montana, Wyoming, Colorado,

New Mexico, Idaho, Utah, Nevada, Arizona, Washington, Oregon, California, and Alaska); where approximately 82% of the nesting pairs in the United States were found in 1998. Taubert *et al.* stated that "...take of peregrines for falconry during the post delisting monitoring period should be conservative to avoid the risk of impeding further population expansion."

In October 1999, we published a Notice of Intent to prepare two Environmental Assessments and associated Management Plans for Take of Wild Peregrine Falcons (USFWS 1999b). We stated that we would protect nestling and dispersing juvenile American peregrine falcons from southeastern Canada and the eastern U.S. while considering a conservative take of nestlings from healthy populations in the western U.S. We published a Draft Environmental Assessment on nestling take for falconry in July 2000, and a final Environmental Assessment and Management Plan and a Finding of No Significant Impact in April and May 2001.

In February 2002, it came to our attention that there was an error in the way the results of modeling done for the earlier draft and final Environmental Assessments were expressed. Though peregrines sometimes breed at an early age, (*e.g.* Tordoff *et al.* 2000, 2001), to be conservative we had intended to model first breeding for peregrines at age three. As a result of the error, in March 2002 the Service decided to reconsider its decision to allow take of nestling American peregrine falcons. This revised Environmental Assessment, Management Plan, and Implementation Guidance corrects the earlier presentation of the modeling data.

In addition, we have concluded that it is probably more important and easier to understand if this assessment focuses on the effects of take on population change, rather than on absolute numbers shown by modeling. We believe the public is better served by including management information in a single document, so like the earlier document, this Environmental Assessment also includes information on management of take.

## **PURPOSE**

In this Environmental Assessment and Management Plan, we consider a limited take of nestlings for falconry while assuring protection for American peregrine falcons. We do so by evaluating the effects of take of nestling American peregrine falcons on estimates of population growth in the western United States. This includes evaluating the effects of the proposal for take of nestlings recommended by the States, *i.e.* take in 11 contiguous western States and Alaska (Taubert *et al.* 1999), and alternatives.

We evaluated impacts on American peregrine falcons resulting from take of nestlings and recent fledglings for falconry in western States. We did not consider the take of eggs for raising birds for falconry, nor did we assess take for other purposes, such as captive propagation or research. We will evaluate requests for take for other purposes

on a case-by-case basis pursuant to the Migratory Bird Treaty Act and the National Environmental Policy Act.

## **NEED FOR ACTION**

Possession of a trained raptor listed under 50 CFR part 10 for falconry is authorized only under a permit issued by the Service (50 CFR 21.28). Falconry is a viable form of recreation, and wild-caught peregrine falcons were an important component of American falconry prior to the species' listing in 1970 (Weaver 1988). We have received requests for take of peregrine falcon nestlings for use in the sport.

Prior to delisting of the American peregrine falcon, we amended captive propagation, scientific collecting, and falconry permits to preclude take of peregrine falcons from the wild. Those amendments likely will remain in effect until the federal falconry regulations are revised, but we may allow take if doing so will not adversely affect the population. We could do so by further amending selected permits to allow take for a specific period of time. Our intent here is to assess possible impacts to determine if take for falconry purposes should be authorized.

## **SCOPING AND PUBLIC PARTICIPATION**

In October 1999, we published a Notice of Intent to prepare two Environmental Assessments and associated Management Plans for Take of Wild Peregrine Falcons (USFWS 1999*b*). We published a Draft Environmental Assessment on nestling take for falconry in July 2000, and opened a 60-day public comment period on the draft. We produced the final Environmental Assessment and Management Plan and a Finding of No Significant Impact in April and May 2001. This Draft Revised Environmental Assessment is published to correct an error in the representation of the modeling done for the draft and final Environmental Assessment in 2000 and 2001. A 60-day public comment period on this draft will be allowed.

## **AUTHORITY AND RESPONSIBILITY**

Regulations allowing the take of migratory birds are authorized by the Migratory Bird Treaty Act (Act) (16 U.S.C. Sections 703-712), which implements the four bilateral migratory bird treaties the United States entered into with Canada, Mexico, Japan, and Russia. The Act authorizes the Secretary of the Interior to allow people to hunt, take, possess, sell, purchase, and transport migratory birds if those actions are compatible with the provisions of the treaties (16 U.S. C. Section 704).

## **AFFECTED ENVIRONMENT**

### **NESTING POPULATION**

The American peregrine falcon is widespread in western North America, from Mexico through Canada and Alaska. As noted, over 80% of the nesting American peregrine falcons in the United States occur in the western States. Also, there is a clear demarcation between eastern and western populations because very few nesting pairs of American peregrine falcons occur in the Great Plains States.

Because the eastern and western populations of American peregrine falcons in the United States are geographically distinct, and because the concentrations of nesting peregrines, such as in the canyon country of Utah and Arizona, are not defined by State boundaries, it is most practical to manage American peregrine falcons in the western U.S. as a single population, though we may discuss or analyze data for any single State population in doing so.

Prior to delisting, nesting recovery plan population goals were reached or exceeded in Alaska, Arizona, California, Colorado, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The nesting population in States west of 100° longitude in 1998 was at least 1091 pairs. Since then, the American peregrine falcon population in the West has grown, and the population in every western State has exceeded the recovery plan goal for the State - most by a substantial number (Table 1)

### **.PEREGRINE FALCON DEMOGRAPHY**

The proposed take of nestling peregrines is, for purposes of determining its effect on the overall population, a proposal to allow a managed increase in first-year mortality. Evaluating the effects of an increase in first year mortality on rates of population growth is not straightforward. Peregrine falcon populations are “a classic example of a species whose population size is limited by Moffat’s equilibrium” (Hunt 1998), where the number of territorial breeders changes as a consequence of spatially-imposed limits on reproduction. For peregrines, the number of available suitable nest sites limits breeding population size. However, when productivity rates exceed mortality rates, the actual size of the adult population may be much larger than breeding population size, owing to the accumulation of non-breeding adult floaters awaiting an opportunity to occupy a nest site and breed. “Peregrine populations are particularly disposed to such limitation because cliffs and other nesting sites are rare in most landscapes and because of territoriality” (W. Burnham and T. Cade, personal communication).

As the population continues to grow, density-dependent effects will play an increasing role in population regulation. As population growth “...begins to level off, and competition intensifies, mortality among young may increase, so that a progressively smaller proportion survive to breed (Newton, 1998, page 18).” Floaters “...represent an important buffer against change, but they may, if too numerous, also interfere with breeding success, causing a density-dependent modulation of overall population size” (G. Hunt, personal communication). In other words, competition between established



TABLE 1. CURRENT PEREGRINE FALCON POPULATION DATA FOR WESTERN STATES.  
See Appendix 1 for details.

STATE	RECOVERY GOAL	NESTING PAIRS 1998	NESTING PAIRS 2001	% CHANGE 1998-2001	% OF GOAL	RECENT PRODUCTIVITY
Alaska	NA	301	550 <sup>1</sup>	+ 83	-	1.54 <sup>2</sup>
Arizona	46	167 <sup>3</sup>	167 <sup>3</sup>	-	363	1.02 (1995-1998)
California	120	167	167 <sup>4</sup>	-	≥139	1.67 (2001)
Colorado	31	76 <sup>5</sup>	96	+ 26	310	1.70 (1999-2001)
Idaho	17	17	19	+ 12	112	1.50 (1998-2001)
Montana	20	18	37	+ 106	185	1.78 (1998-2001)
Nevada	5	6	9	+ 50	180	No Data
New Mexico	23	32	37 <sup>6</sup>	+ 16	161	1.47 (1999-2001)
Oregon	30	53 <sup>7</sup>	65 <sup>8</sup>	+ 23	217	1.39 (1998-2000)
Utah	21	164	164 <sup>9</sup>	-	≥781	1.30 (1991-1996)
Washington	30	45	62	+ 38	207	1.49 (1998-2001)
Wyoming	14	42	44	+ 5	314	1.74 (1998-2001)
Western U.S., except Alaska	357	790	867	+ 10	230	1.51 <sup>10</sup>
Western U.S.	NA	1,091	1,417	+ 30	-	1.51 <sup>10</sup>

<sup>1</sup> 2002 estimate is 550 to 750 pairs. Includes data for areas not previously assessed.

<sup>2</sup> Data from Colville, Sag, Tanana, and Yukon rivers, 1995-2002 (unpublished data, K. Titus, personal communication, 2002).

<sup>3</sup> Correction of Final Delisting Rule data from D. Shroufe, Arizona Game and Fish Department.

<sup>4</sup> For this assessment, we assume no population growth. No statewide survey done; productivity data compiled for 45 aeries in the State.

<sup>5</sup> Correction of Final Delisting Rule data from J. Craig, Colorado Division of Wildlife.

<sup>6</sup> Minimum number of nesting pairs

<sup>7</sup> Correction of Final Delisting Rule data from M. Nugent, Oregon Department of Fish and Wildlife.

<sup>8</sup> Year 2000 population, no population data for 2001.

<sup>9</sup> For this assessment, we assume no population growth. No data for 2001 reported.

<sup>10</sup> Unweighted mean (see text).

breeders and floaters, both for nest sites and food, can be expected to reduce nesting success and perhaps first-year survival in saturated populations.

Peregrines, like many other raptors, are capable of breeding at age two (and occasionally age one), which is younger than the average age of first breeding (Newton and Mearns 1988). When a population is increasing and an insufficient number of older adults are available to occupy suitable nest sites, younger birds can take advantage of the opportunity to breed. Although younger birds are often not as successful as older breeders, the resultant lowering of the age at first breeding can still have a positive

effect on population growth rates. The same effect can occur in a decreasing population, thereby buffering the effects of a decline.

Because of the complicated and as yet poorly understood interaction between population size and population growth rate under Moffat's equilibrium for peregrine falcons, and given mechanisms that could serve to buffer both increases and declines, it is difficult to accurately predict the effects of the proposed take of nestling peregrines on population growth. However, given reasonable estimates of productivity and age-specific survival, we can assess the magnitude of change in growth rate expected with a given change in first year mortality in the absence of buffering changes in other demographic parameters. The data on productivity and age-specific mortality in the affected population are sufficient to assess the changes to an acceptable level of accuracy.

#### PRODUCTIVITY

The number of young produced by a nesting pair is difficult to assess because their aerie may be difficult to see and to visit. In many cases, the number of young fledged is determined on a visit to the site just after fledging, and it may be difficult to see all of the young. We recognize that there are biases in productivity estimates, and there probably is variation within and among the productivity data sets in different locations. However, based on the reports and discussions with State biologists, we conclude that the data collections comply with the standard suggested by Steenhof (1987), who proposed a minimum of two properly-timed surveys conducted to minimize disturbance of nesting pairs. We believe the State data are the best on American peregrine falcon productivity in the western U.S.

Most productivity goals set by recovery teams in the West were met prior to delisting. Data from western States show that recent productivity has been approximately 1.51 young per nesting attempt, which is the unweighted mean (the mean of the State productivity values) of the figures for the States that reported productivity data in 2002 (Table 1). An unweighted mean assigns equal importance to the values from each of the States, which we believe is appropriate because of differences in the population sizes, survey timing, and annual survey activities among the States. In other words, the value for a State that surveys 100 aeries every year, for example, should be weighted no more than the value from a State that surveys 25 aeries every third year. The unweighted means better reflect differences in prey availability, habitat, and aerie distribution.

#### MORTALITY

Mortality is an important consideration in management of American peregrine falcons. Recent analyses of band return data for American peregrine falcons from Colorado indicate that first-year mortality is about 46%, and mortality in the second year is about 33% (J. Ver Steeg, personal communication). Band recoveries indicated that first year mortality in Arctic (*F. p. tundrius*) and American peregrine falcons was 62.5% from 1955 through 1985 (Yates *et al.* 1988).

Mortality was a maximum of 23% per year for adult female American peregrine falcons in Alaska (Ambrose and Riddle 1988), and was estimated at 25% in the U.S. (Enderson 1969). Enderson and Craig (1988) estimated a maximum loss for males and females of 16% per year in Colorado in 1980 and 1981. Annual loss of territorial peregrines in northern New Mexico from 1980 through 1986 was estimated at 24%; annual loss of males was 15%; loss of females was 33% (Johnson 1988). More recently, first-year mortality was estimated at 54%, and post-first year mortality at 25% in New Mexico (C. Hayes, personal communication). Apparent mortality of post-second-year American peregrine falcons in Colorado in recent years has been approximately 20% per year (J. Ver Steeg, personal communication).

Because American peregrine falcons grade into Arctic peregrine falcons across the northern part of the American peregrine falcon range in North America, and because they share the same migration pathways across North America, mortality estimates for Arctic peregrine falcons also help to assess mortality of American peregrine falcons. Based on resightings of nesting Arctic peregrine falcon adults in Alaska, annual mortality there is estimated at 18 to 25% (J. Wright, personal communication). Annual mortality for adult Arctic peregrines on northwest Hudson Bay was 19% (Court *et al.* 1989).

To assess population growth of eastern peregrines, Grier and Barclay (1988) used 20% for post-first-year mortality to develop life tables for peregrines under different conditions. Sweeney *et al.* (1997) and Tordoff and Redig (1997) reported that mortality of rehabilitated peregrines in the Midwest was about 14% per year for birds one year old or more. It is important to note that these estimates of mortality were derived from mark-recapture or band recovery analysis models. Neither approach readily distinguishes between mortality and permanent emigration. Accordingly, these results likely overestimate mortality in proportion to the probability of permanent emigration, which probably varies with age and sex (Newton and Mearns 1988).

Although a high proportion of peregrines taken by falconers may escape and return to the wild (a factor that may reduce the impact of take for falconry on continued population growth), the subsequent fitness of these individuals is not known. Therefore, Taubert *et al.* (1999) recommended that "...until data on the comparative fitness of released peregrines are available, it would be "prudent to consider birds taken for falconry as permanently removed [from the wild]." That is what we have done for this assessment.

## **ALTERNATIVES**

We considered five alternatives for take of nestling American peregrine falcons in the western United States and Alaska. Alternative 1 would maintain the status quo, with no authorized take for falconry.

Alternative 1: No Action. The addition in 1999 of a condition on falconry, captive propagation, and scientific collecting permits that prohibits take of peregrine falcons

from the wild in the contiguous United States means that, absent a decision to remove that condition, peregrine falcons may not be taken from the wild for falconry. Under this alternative, the restriction would be left in place and no take of nestlings would be authorized.

Alternative 2: Take of 5% of annual production. This is the proposed action. In each State west of 100° longitude, take of up to 5% of the annual production of American peregrine falcons for use in falconry would be authorized. Under this alternative, with average productivity, a minimum nesting population of 14 pairs would be required before take for falconry in a State could be authorized. At 1.51 young per nesting attempt, 14 nesting pairs could be expected to produce 21 young. Take of 5% of 21 young would allow take of one nestling in the State for falconry. If the average productivity in the State is lower, the population there would have to be larger to allow take at this level.

Alternative 3: Take of 10% of annual production. In each State west of 100° longitude, take of up to 10% of the annual production of nestlings of American peregrine falcons for falconry would be authorized. Under this alternative, with average productivity, a minimum nesting population of 7 pairs would be required before take for falconry in a State could be authorized. At 1.51 young per nesting attempt, 7 nesting pairs could be expected to produce 10 young. Take of 10% of 10 young would allow capture of one nestling in the State for falconry. If the average productivity in the State is lower, the population there would have to be larger to allow take at this level.

Alternative 4: Take of 15% of annual production. In each State west of 100° longitude, take of up to 15% of the annual production of American peregrine falcons for use in falconry would be authorized. Under this alternative, with average productivity, a minimum nesting population of 5 pairs would be required before take for falconry in a State could be authorized. At 1.51 young per nesting attempt, 5 nesting pairs could be expected to produce 7 young. Take of 15% of 7 young would allow take of 1 nestling in the State for falconry. If the average productivity in the State is lower, the population there would have to be larger to allow take at this level.

Alternative 5: Take of 20% of annual production. In each State west of 100° longitude, take of up to 20% of the annual production of American peregrine falcons for use in falconry would be authorized. Under this alternative, with average productivity, a minimum nesting population of 4 pairs would be required before take for falconry in a State could be authorized. At 1.51 young per nesting attempt, 6 nesting pairs could be expected to produce 6 young. Take of 20% of 6 young would allow take of 1 nestling in the State for falconry. If the average productivity in the State is lower, the population there would have to be larger to allow take at this level.

Alternative 6: lift all restrictions on take. Under this option, the restriction on take for falconry in States west of 100° longitude would be lifted. Regulation of take of American peregrine falcons would be managed by the States (within the limits of the

Federal falconry standards). At the extreme, with approximately 4000 permitted falconers in the U.S., most of whom could take two nestlings if they were allowed to do so by the States, this could mean that all nestlings produced might be taken for falconry.

## **ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES**

The overall number of raptors taken for falconry is small. In 2000, 1014 raptors were reported taken for falconry in the United States, approximately half of which were red-tailed hawks (*Buteo jamaicensis*) (USFWS data).

Healthy peregrine and goshawk populations can sustain 10%, and potentially 20% annual removal of juveniles by falconers (Kenward 1997). Conway *et al.* (1995) removed 9 to 27% of the production in a population of prairie falcons (*Falco mexicanus*) in Wyoming for a five-year period. They estimated the minimum sustainable yield to be 10 to 20% of the nestlings annually. Though data on the effects of take of nestling raptors are limited, we believe that the take of raptors by falconers is “inconsequential to populations” (USFWS 1988).

There might be slight effects of this action on wildlife habitats due to increased travel to nesting areas, but we discounted those effects because they would be negligible. We found no likely environmental impacts to air or water quality, to other wildlife populations, or to any other component of the environment.

Unintentional take associated with take of American peregrine falcons for falconry is possible. Such take could affect the condition of an aerie or the number of young fledged in a nesting attempt. This could happen, for example, if the aerie substrate is damaged or if nestlings are injured because of the attempt to take a nestling for falconry. Such events also might cause abandonment of the aerie. Though there are reported concerns about this possibility, we are aware of no data suggesting that such occurrences would significantly affect the population modeling or our conclusions. Furthermore, take at any such locations could be restricted by a State if it decided to allow take of nestlings.

Not all raptors taken by falconers are permanently removed from the wild. Some are purposely released and others are lost when hunting. Available data suggest that the rate of return to the wild averages 30–40% annually for a variety of species (Kenward *et al.* 1981, Mullenix and Millsap 1998). Loss rates for peregrines could be higher because peregrines range more widely in flight. Enough goshawks (*Accipiter gentilis*) lost by falconers survived to reestablish a population in Great Britain (Kenward *et al.* 1981). Still, Taubert *et al.* (1999) recommended that “...until data on the comparative fitness of released peregrines are available,” it would be “prudent to consider birds taken for falconry as permanently removed.” This is particularly true of birds taken as nestlings, which may do poorly in the wild if they escape.

There are other considerations in allowing the take of nestlings. Take of nestlings for falconry, if it reduced the population, might minimally reduce growth of nonconsumptive uses of peregrines such as avocational birdwatching.

Monetary gain for raptor propagators could decline slightly if wild birds are taken because the demand, and therefore the prices paid, for captive-bred birds might be reduced. However, falconers could be expected to spend money to travel to capture wild peregrines. We believe these economic impacts of allowing take for falconry are minimal and can be discounted. We evaluated only the biological effects of take.

#### CUMULATIVE IMPACTS

We expect the cumulative impacts of human activities on peregrines to continue to be small. The largest single cause of the peregrine population decline was persistent pesticides - a problem substantially reduced by prohibition of the pesticides in the U.S. Another potential cause of mortality or abandonment of nesting, recreational rock climbing, sometimes occurs in areas used by nesting peregrine falcons (e.g. Garrison and Spencer 1996). Recreational rock climbing may need to be carefully managed in some locations, but will not have a substantial effect on the American peregrine falcon population. Land use activities likely will have the largest effect on peregrines, but the population growth in the western U.S. indicates that peregrines continue to expand their use of the available habitats despite possible detrimental land use activities. However, we will continue to review new data on cumulative impacts of human activities and the status of the American peregrine falcon population in the western U.S.

#### DETERMINATION OF EFFECTS OF TAKE FOR FALCONRY

As discussed previously, modeling the effects of the proposed activity on peregrine populations is difficult given the complicated demography of the species. In our earlier assessment, we attempted to predict actual population growth rates using the best available estimates of productivity and age-specific survival. However, our model using the best data available predicted no change in population size, yet data from the States show considerable growth since 1998. Based on the reports from the States, we believe a small amount of this increase likely is due to increased search effort, but we believe the majority of the population growth seen since delisting is due to actual population growth rather than to increased search efforts. We conclude that one or more of our parameter estimates in those models was inaccurate.

We believe the estimates of productivity are relatively accurate despite inherent biases. Moreover, the data analyses suggest that American peregrine falcon population growth rates are little affected by slight to moderate changes in productivity. This leads us to suspect that estimates of mortality are inflated. This is consistent with the inherent bias in these estimates due to an inability to account for permanent emigration. Our analyses indicate that populations are relatively unaffected by slight to moderate changes in first-year survival, which leads us to focus on adult survival as the parameter that is most important for American peregrine falcons.

We used the most current population and productivity data to extrapolate an estimate for post-first-year mortality in the western U.S. Based on those data, we believe that recent post-first-year mortality has been less than 20% per year.

There are two other factors we estimated for modeling purposes: age at first breeding, and sex ratio of nestlings and of the harvest. Peregrines may reproduce before age three in a growing population. In the Midwest, about 11% of the nesting pairs included at least one two-year-old bird from 1987 through 1992. More recently they have comprised less than 2% of the nesting population (Tordoff *et al.* 2001). We know of no comparable assessment for other parts of the country, but to be conservative we assessed the effect of take in a population with different proportions of breeding two-year-olds and different rates of change in the percentage of two-year-olds breeding. We determined that changes in these values make relatively little difference in ( $\lambda$ ), which is the per capita change in a population over a unit of time (Williams *et al.* 2002). In addition, we believe that, as in the Midwest, once the population stabilizes there will be a low proportion of two-year-olds nesting. However, to be conservative in this assessment, we chose to account for the likelihood that some two-year-olds are nesting in the growing population.

We assumed a 50:50 ratio of male and female nestlings and equal take of male and female nestlings, which we will monitor across all States that permit take, if take is allowed. Our assessment of the effects of take is based on the results of deterministic modeling. To evaluate the maximum effect of each level of take in the absence of buffering effects on other parameters, we determined the change in  $\lambda$ .

#### BIOLOGICAL EFFECTS OF THE ALTERNATIVES

Alternative 1: No Action. Under this alternative there would be no take for falconry. Data provided by the States indicate a considerable increase in the number of known nesting pairs of American peregrine falcons in the western United States since delisting (Table 1). We would expect continued growth of the population under this alternative until all available nesting sites are used.

Alternative 2 (Proposed Action): Take of 5% of annual production. This alternative would allow an initial annual take of up to 84 nestlings (pairs per State  $\times$  average productivity for the State  $\times$  0.05, with all take rounded to the next lowest whole number) if all States west of 100° longitude allow the maximum take. If this level of take were allowed,  $\lambda$  would be reduced by no more than 0.8%. Allowed take under this alternative would be no greater than 27 in Alaska<sup>1</sup>, 8 in Arizona, 13 in California, 8 in Colorado, 1 in Idaho, 3 in Montana, 0 in Nevada, 2 in New Mexico, 4 in Oregon, 10 in Utah, 5 in Washington, and 3 in Wyoming.

Alternative 3: Take of 10% of annual production. This alternative would allow an initial annual take of up to 175 nestlings if all States west of 100° longitude allow the maximum take. If this level of take were allowed,  $\lambda$  would be reduced by approximately

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<sup>1</sup> Based on productivity of 1.00 young per nesting attempt, as suggested by the State.

1.5%. Allowed take under this alternative would be no more than 55 nestlings in Alaska, 17 in Arizona, 27 in California, 16 in Colorado, 2 in Idaho, 6 in Montana, 0 in Nevada, 5 in New Mexico, 9 in Oregon, 21 in Utah, 10 in Washington, and 7 in Wyoming.

Alternative 4: Take of 15% of annual production. This alternative would allow an initial annual take of up to 264 nestlings if all States west of 100° longitude allow the maximum take. If this level of take were allowed,  $\lambda$  would be reduced by approximately 2.2%. Allowed take under this alternative would be no more than 82 nestlings in Alaska, 25 in Arizona, 41 in California, 24 in Colorado, 4 in Idaho, 9 in Montana, 0 in Nevada, 8 in New Mexico, 13 in Oregon, 31 in Utah, 16 in Washington, and 11 in Wyoming.

Alternative 5: Take of 20% of annual production. This level of take would allow an initial annual take of up to 355 nestlings if all States west of 100° longitude allow the maximum take. If this level of take were allowed,  $\lambda$  would be reduced by approximately 3.1%. The maximum take allowed under this alternative would be: Alaska - 110, Arizona - 34, California - 55, Colorado - 32, Idaho - 5, Montana - 13, Nevada - 0, New Mexico - 10, Oregon - 18, Utah - 42, Washington - 21, and Wyoming - 15.

Alternative 6: lift all restrictions on take. Under this alternative, the current permit amendment prohibiting take of peregrine falcons in the U.S. would be changed. Each State west of 100° longitude would regulate take of nestlings for falconry, within the limits of the Federal falconry standards. There are just over 4000 federally-permitted falconers in the United States. Approximately 3500 of them could legally take two peregrines for falconry each year if a State or States allowed it.

#### EFFECTS OF ALTERNATIVES ALLOWING TAKE

The only quantifiable negative environmental effect of proposed take is the possible effect on American peregrine falcon population growth; growth could decrease if take is authorized - noticeably so under alternative 6. However, our evaluation of changes in  $\lambda$  due to falconry take make it clear that this activity, if allowed, would have a very limited effect on American peregrine falcon population changes (Appendix 2). In fact, lowered production of fledglings has very little effect on the rate of population change. The driving force in maintenance of the population is adult survival. Under the preferred alternative, we believe the allowed take would change the rate of population change by only about 0.5% initially because we do not expect all western States to allow take (Table 2). Such take would not produce a population change that could be detected in any population monitoring. Moreover, we believe that population buffering mechanisms (e.g. reduced aerie site competition) would further reduce the impacts of take on population growth.

#### TRANS-BOUNDARY EFFECTS OF ALTERNATIVES ALLOWING TAKE

Peregrine falcons exhibit considerable fidelity to nesting sites that they know. They “are highly philopatric and have strong tendencies to home back to their natal localities, rather than to explore far away for new nesting opportunities” (Cade 1982). We conclude that with this tendency and the limited effects on population growth of



TABLE 2. POSSIBLE ALLOWED TAKE OF NESTLING AMERICAN PEREGRINE FALCONS IN 2004.

State	Nesting Population	Productivity	Production	Possible Take				Allowed by USFWS	Allowed by State <sup>1</sup>
				@ 5%	@ 10%	@ 15%	@ 20%		
Alaska	550-750	1.00	550	27	55	82	110	27	6
Arizona	167	1.02	170	8	17	25	34	8	6
California	167	1.67	278	13	27	41	55	13	0
Colorado	96	1.70	163	8	16	24	32	8	4
Idaho	19	1.50	28	1	2	4	5	1	0
Montana	37	1.78	65	3	6	9	13	3	0
Nevada	9	Not Determined		0	0	0	0	0	0
New Mexico	37	1.47	54	2	5	8	10	2	0
Oregon	65	1.39	90	4	9	13	18	4	0
Utah	164	1.30	213	10	21	31	42	10	10
Washington	72	1.49	107	5	10	16	21	5	5
Wyoming	44	1.74	76	3	7	11	15	3	0
Total/ Over all			1794	84	175	264	355	84 (≈4.8%)	31 (≈1.5%)

<sup>1</sup> Expected in 2004.

alternatives 1 through 5, there would be only a slight possibility of a minimal effect on peregrine populations outside the western United States. Under Alternative 6, a high level of take might slow population growth in new locations by allowing take of nestlings that might nest outside the area in which take for falconry would be allowed.

## MANAGEMENT OF FALCONRY TAKE

If take is allowed, we will use updated information to make changes in management of take of American peregrine falcons as necessary. Each year a State/Federal Management Team (MT) will review the take of nestlings and recommend adjustments in allowed take of nestlings or other appropriate actions to the DMBM. We will use those recommendations and current information to adjust take accordingly as the population changes.

The MT will consist of one State fish and wildlife agency employee selected from each of the following: the Western Association of Fish and Wildlife Agencies, the Association of Midwest Fish and Wildlife Agencies, the Northeast Association of Fish and Wildlife Agencies, and the Southeast Association of Fish and Wildlife Agencies; and one from the International Association of Fish and Wildlife Agencies. A representative from the U.S. Fish and Wildlife Service also would serve on the MT. Other State agency representatives may participate in MT meetings and provide recommendations and comments to other States and to the U.S. Fish and Wildlife Service. The team will be co-chaired by the U.S. Fish and Wildlife Service representative and by a State agency

representative. The MT will meet annually each spring, and each year will produce a report to the States and the Fish and Wildlife Service. The report will include sections on the adequacy of the management of take and on recommendations for changes in take.

Each State that authorizes take of nestlings, if it is allowed, must report by November 1<sup>st</sup> each year to the DMBM on the number of male and female nestlings taken for falconry and on the results of new population or productivity surveys. Each State can provide suggestions to the MT for adjustments in management of take, and will provide updated information on the American peregrine falcon nesting population and

productivity in the State. The DMBM will provide the data to the MT by December 1<sup>st</sup>. The U.S. Fish and Wildlife Service will review the allowed take each year to assess effects of take for falconry on the nesting population. Updated population or productivity data will be considered as they become available, and will be used to revise the allowed take, as appropriate.

If take is allowed, each year the MT will review the DMBM report on take of nestlings and additional information provided by the States. The MT will consider monitoring data, including the latest post-delisting monitoring information, and will review information on unintentional take of adults or nestlings, productivity information, and bias in take of female or male nestlings. The MT will then produce a report to the States and the U.S. Fish and Wildlife Service by January 15<sup>th</sup> each year, to include sections on compliance with, and adequacy of, the restrictions on take described in this plan and enforced by permit. The U.S. Fish and Wildlife Service will then adjust take as appropriate and make any other needed decisions about management of the populations and nestling take. If necessary, adjustments to take will include measures to balance take of male and female nestlings across the western States.

The best available information for each State will be used to determine the take allowed, if it is allowed there. If take is allowed, it will not exceed the level decided on (for example, 5% of nestlings produced). To ensure that take has a minimal effect on  $\lambda$ , the number of nestlings authorized to be taken in any State will be reevaluated if population monitoring shows a statistically significant decline in territory occupancy in any of the three regions for Endangered Species Post-delisting monitoring (USFWS 2003) that include western States.

Because aerie occupancy is not the sole indicator of the status of a population, we also will evaluate the take (if take is authorized) in light of other reliable information about the status of the American peregrine falcon in the western United States. This may include regional or State information on productivity or population levels. However, a decline in productivity, for example, might not by itself be cause for a change in the level of take. As noted earlier, adult survival is the parameter that is most important for maintenance of American peregrine falcon populations. Due to competition between established pairs and floaters for nesting opportunities and increased competition

among nesting pairs, a decline in productivity is likely as suitable nesting habitat is filled.

As with management of take of other species for falconry, the States may regulate details of take, consistent with the federal falconry regulations. Those details may include whether to allow take of nestlings, timing and location of take of nestlings, restrictions on aerie access, and allocation of take among interested falconers. For example, any State in which take is allowed may employ models to assess population changes and the effects of take, and may implement take according to any guidance it develops. The allocation and management of take up to the 5% limit are at the discretion of each State in which take is allowed. The number of nestlings taken in any State may not be increased within the 5% limit unless a new State survey shows an increase in the nesting population or in productivity sufficient to warrant the increase.

If post-delisting endangered species monitoring shows a statistically significant decline in territory occupancy in any of the three regions for Endangered Species Post-delisting monitoring (USFWS 2003) that include western States, or if we determine that new impacts such as West Nile Virus or new pesticides substantially affect the population, the authority for take may be revoked until and unless it can be demonstrated that such declines are not caused by the falconry harvest and do not threaten the species.

The MT may recommend changes in the nestling take. However, to increase the percentage taken, or if a State east of those covered in the initial plan requests take, the MT will provide recommendations to the Fish and Wildlife Service on the issue. We will prepare a supplemental Environmental Assessment to assess the request and relevant peregrine population information.

## **IMPLEMENTATION OF TAKE**

If take is allowed, falconers and the States should take measures to avoid damage to aeries and to minimize disturbance of Peregrine falcons. For example, individuals entering aeries should be skilled in rappelling and climbing safety measures. Removal of young from aeries vulnerable to physical damage should be carefully managed. We prefer nestling take at aeries where nestlings are deemed by a State to be at high risk, such as those on bridges and building ledges, instead of at natural aeries.

The following guidance lists required permit conditions, and is within the limits of the Federal falconry regulations. This guidance will be in effect as part of the process for taking falcons, if take is allowed. The States could invoke more stringent conditions.

1. To avoid premature fledging of nestlings, aeries should not be entered when young are 28 days or more of age.
2. At least one nestling must be left in each aerie prior to fledging.
3. A fledgling may be trapped for up to 30 days after fledging.
4. Each falconer who takes a nestling from the wild must report the sex and precise information about the capture location for each bird to the appropriate State

wildlife agency and to the U.S. Fish and Wildlife Service within five days of the take of the bird. If the falconer determines after submitting the information about the sex of the bird that his or her initial report was incorrect, the report to the Fish and Wildlife Service should be corrected.

5. The falconer also should submit two plucked breast feathers from the nestling to the U.S. Fish and Wildlife Service. The feathers may be submitted with the form 3-186A reporting take of a wild bird for falconry. The U.S. Fish and Wildlife Service will collect the feathers in anticipation of stable isotope analyses of them for information about the origins of North American peregrines. The laboratory for analyses of the feathers will be selected through the contracting process.

Should take of nestlings be allowed, until revised Federal falconry regulations are in place, the procedure in use for managing the take will be as follows.

1. A State that chooses to allow take will select permittees to do so.
2. Each falconer selected must notify his or her Fish and Wildlife Service permits office and request that his or her permit be amended to allow take of a nestling under the conditions specified by the State.
3. We will amend the individual's permit to allow take of one nestling in that calendar year.

## **CONSULTATION**

To prepare this assessment, we consulted individuals in the following agencies and organizations for information and advice.

Alaska Department of Fish and Game  
Arizona Game and Fish Department  
California Department of Fish and Game  
Colorado Division of Wildlife  
Idaho Department of Fish and Game  
International Association of Fish and Wildlife Agencies  
Nevada Division of Wildlife  
New Mexico Fish and Game Department  
Montana Department of Fish, Wildlife and Parks  
Oregon Department of Fish and Wildlife  
Utah Division of Wildlife Resources  
Washington Department of Fish and Wildlife  
Wyoming Game and Fish Department

## **SOURCES OF CURRENT POPULATION INFORMATION**

Alaska: Jon Wright, personal communication, February 2002; Kim Titus and Jon Wright, personal communication, September 2002.

Arizona: Duane Shroufe; personal communication, December 2001.

California: Ron Jurek, personal communication, February 2002.

Colorado: Jeff Ver Steeg, personal communications, March 2002 and September 2002.

Idaho: Rex Sallabanks, personal communication, January 2002.

Montana: J. Sumner and R. Rogers, 2001. Montana Peregrine Falcon Survey. Sumner Consulting; Bozeman, Montana. Unpublished Report. Also Jeff Hagener, personal communication, February 2002.

Nevada: Larry Neel, personal communication, February 2002.

New Mexico: Charles Hayes, IV; personal communication, January 2002.

Oregon: Martin Nugent, personal communication, February 2002.

Utah: No response from Utah to requests for data.

Washington: J. Brookshier; personal communication, January 2002.

Wyoming: J. Baughman; personal communication, January 2002; B. Oakleaf, personal communication, February 2002.

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This document was prepared by George T. Allen.

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# APPENDIX 1

## PRODUCTIVITY DATA PROVIDED BY THE STATES IN 2002

State	YOUNG PRODUCED					NESTING PAIRS					MEAN YOUNG PER NESTING PAIR				TOTAL
	1998	1999	2000	2001	TOTAL	1998	1999	2000	2001	TOTAL	1998	1999	2000	2001	
Alaska					550 <sup>1</sup>					550 <sup>1</sup>					1.54 <sup>1</sup>
Arizona					170					167					1.02
California				60	60				36	36				1.67	1.67
Colorado		116	205	130	451	73	97	96		266	1.59	2.11	1.35		1.70
Idaho	30	22	36	32	120	17	21	23	19	80	1.76	1.05	1.57	1.68	1.50
Montana	30	43	59	66	198	18	27	29	37	111	1.67	1.59	2.03	1.78	1.78
New Mexico		55	65	55	175		39	43	37	119		1.41	1.51	1.49	1.47
Oregon	70	81	85		236	51	54	65		170	1.37	1.50	1.31		1.39
Utah					213					164				1.30	1.30
Washington	81	79	75	112	347	45	59	57	72	233	1.80	1.34	1.32	1.56	1.49
Wyoming					302 <sup>2</sup>					174 <sup>2</sup>					1.74
Total Excluding Alaska					2272					1520					
TOTAL	211	396	525	1137	2822	131	273	314	791	2070	1.61	1.45	1.67	1.44	1.51 <sup>3</sup>

<sup>1</sup> Data from Colville, Sag, Tanana, and Yukon rivers, 1995-2002 (unpublished data, K. Titus, personal communication, 2002).

<sup>2</sup> Combined data reported for 1998-2001, not for individual years

<sup>3</sup> Unweighted mean (average of State means)

Mean of individual State values: 1.51

Variance of mean of individual State values: 0.07

Standard deviation of mean of individual State values: 0.27

95% confidence interval on mean of individual State values: 0.18

Upper bound, 95% confidence interval on mean of individual State values: 1.65

Lower bound, 95% confidence interval on mean of individual State values: 1.36



## APPENDIX 2

### RATE OF POPULATION CHANGE WITH DIFFERENT LEVELS OF TAKE AND DIFFERENT PROPORTIONS OF TWO-YEAR-OLDS BREEDING

Productivity = 1.51 young per nesting attempt, first-year mortality = 62.5%.

Initial Proportion of 2-Year-Olds Breeding	Percent per Year Decrease in Proportion	Post-First-Year Mortality	Take Level	Lambda	Approximate Reduction in Lambda
0.40	5	10%	0	1.10	.
			5%	1.09	1%
			10%	1.08	2%
			15%	1.08	3%
			20%	1.07	3%
		15%	0	1.05	.
			5%	1.04	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.02	3%
		20%	0	0.99	.
			5%	0.99	1%
			10%	0.98	2%
			15%	0.97	3%
			20%	0.96	3%
	10	10%	0	1.10	.
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.07	3%
		15%	0	1.04	.
			5%	1.04	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	.
			5%	0.98	1%
			10%	0.98	2%
			15%	0.97	3%
			20%	0.96	3%
	20	10%	0	1.10	.
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.07	3%
		15%	0	1.04	.
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	.
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%

Initial Proportion of 2-Year-Olds Breeding	Percent per Year Decrease in Proportion	Post-First-Year Mortality	Take Level	Lambda	Approximate Reduction in Lambda
0.30	5	10%	0	1.10	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.04	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.98	2%
			15%	0.97	3%
			20%	0.96	3%
	10	10%	0	1.10	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.04	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.98	2%
			15%	0.97	3%
			20%	0.96	3%
	20	10%	0	1.09	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%

Initial Proportion of 2-Year-Olds Breeding	Percent per Year Decrease in Proportion	Post-First-Year Mortality	Take Level	Lambda	Approximate Reduction in Lambda
0.20	5	10%	0	1.10	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.07	3%
		15%	0	1.04	-
			5%	1.04	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.98	2%
			15%	0.97	3%
			20%	0.96	3%
	10	10%	0	1.04	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%
	20	10%	0	1.09	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%

Initial Proportion of 2-Year-Olds Breeding	Percent per Year Decrease in Proportion	Post-First-Year Mortality	Take Level	Lambda	Approximate Reduction in Lambda
0.10	5	10%	0	1.09	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%
	10	10%	0	1.09	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%
	20	10%	0	1.09	-
			5%	1.09	1%
			10%	1.08	2%
			15%	1.07	3%
			20%	1.06	3%
		15%	0	1.04	-
			5%	1.03	1%
			10%	1.03	2%
			15%	1.02	3%
			20%	1.01	3%
		20%	0	0.99	-
			5%	0.98	1%
			10%	0.97	2%
			15%	0.97	3%
			20%	0.96	3%

Initial Proportion of 2-Year-Olds Breeding	Post-First-Year Mortality	Take Level	Lambda	Approximate Reduction in Lambda
0	10%	0	1.09	-
		5%	1.09	1%
		10%	1.08	2%
		15%	1.07	3%
		20%	1.06	3%
	15%	0	1.04	-
		5%	1.03	1%
		10%	1.05	2%
		15%	1.02	3%
		20%	1.01	3%
	20%	0	0.99	-
		5%	0.98	1%
		10%	0.97	2%
		15%	0.97	3%
		20%	0.96	3%